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## THE CLASSIFICATION OF LICHENS

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Systematists have for a long time awaited the coming of the man with convictions sufficiently strong and insight sufficiently keen to produce order out of the long existing lichen chaos. Individual workers have not been wanting who were ready and willing to propose temporary makeshift systems of classification, which in the light of further scientific research proved inadequate and untenable. Only within very recent years has our knowledge of this group of plants become sufficiently advanced and complete to make possible an attempt at a natural system of classification, or at least a system sufficiently concise to give it equal rank with the systems of other comprehensive plant groups. This was made possible by the epoch-making observations and researches of Schwendener, Bornet, Zukal, Reinke and others. In the Lieferungen of Engler and Prantl's Pflanzenfamilien, devoted to lichens, we have perhaps the first more complete summary of modern lichenology and the first effort at formulating a natural system in accord with recent research. Fünfstück's exposition and discussion of general lichenology in Lieferung 180 is complete, concise and quite impartial. This masterpiece of lichenological literature appeared in 1898 and will remain the standard authority for some years to come. An English translation with annotations and additions issued as a separate volume would prove of great value to English students of lichenology and it is to be hoped that some one will undertake this task at an early date.

The only number (Lieferung) thus far issued on the classification of lichens, by A. Zahlbruckner, did not appear until 1903. While the lichens are treated separately, both by Fünfstück and [Vol. 5, No. 4, of TORREYA, comprising pages 55-78, was issued April 27, 1905.]

Zahlbruckner, they nevertheless place them with fungi, parasitically associated with algae. This is all the more remarkable since Fünfstück very concisely sets forth those morphological, physiological and chemical characteristics of lichens, which clearly indicate their autonomous nature. He refuses to look upon the relationship of fungus and alga as mutually beneficial, and designates it as a special or peculiar form of parasitism ("eine besondere Art von Parasitismus"). It is furthermore a misapprehension of the expression "mutualistic symbiosis" to interpret it as meaning that the several symbionts are equally benefited. The term simply implies that the several symbiotic components are benefited (which is frankly admitted by Fünfstück) but that one may receive the greater return favor or benefit. There are some botanists who refuse to recognize in this wonderful biological relationship anything more than ordinary parasitism. Such a deduction is possible only when the components or symbionts are considered separately and not in their mutual relationship. For example, in like manner it is possible to reach the conclusion that the domestic animal is injuriously affected through the influence of man, or that civilized man himself is merely a parasitized or degenerate form of the ignorant savage. To speak of the algal (gonidial) symbiont as imprisoned and parasitized is as irrational as to speak of the imprisoned and parasitized horse or cow. It is very true, man uses the milk, the hide, the hair, the teeth, the meat, the bones, the hoof, in fact every part of the animal. It does look like a clear case of the most pronounced one-sided parasitism, but the aspect is changed markedly as soon as we consider both animals, the cow and the man, in their mutual relationship. Had it not been for man, the cow would perhaps not exist at all; as it is, millions of these animals enjoy a life of luxury as compared with the life they would be compelled to lead as independent unparasitized wild animals. Who can then say that the relationship is not mutualistic? By analogy the same argument applies to the alga and fungus in the lichen-group, only here we have a true symbiotic relationship. It would be a waste of effort again to present the familiar arguments in favor of lichen autonomy or lichen mutualism. The interested reader is referred to

the work of Fünfstück. I wish to refer to one point only. While it is generally admitted that the lichen components or symbionts may develop and exist independently under artificial conditions, at least up to a certain stage, there is no evidence that such is the case in nature. The statement has been made that the algal symbiont may escape from the thallus and vegetate independently on bark, etc., but it lacks proof. Even though that were the case, the fungal symbiont does not exist independently in nature and hence a lichen is an impossibility without the mutualistic association of alga and fungus. No one has yet succeeded in forming a lichen by associating a true alga (*Cystococcus*) with a true ascomycetous fungus. If this were possible we might reasonably expect spontaneously synthetic lichen formations in nature, which is certainly not the case. Lichens invariably arise from preëxisting lichens. Some authorities state that a fungus may attack nostoc colonies and transform them into collematous lichens but this statement requires verification.

Therefore, without entering into what would merely be useless discussion and repetition, it would appear to the writer that the most plausible and reasonable attitude to take toward lichen classification is to consider them as a distinct class. This is the conclusion reached after a perusal of the more important literature on the subject and a rather careful study of the morphology (gross and minute) and ecology of the more important representatives of this very interesting group of plants.

While the system proposed by Zahlbruckner is undoubtedly the best in existence, there are nevertheless several changes which would appear to be desirable. Fünfstück calls attention to the fact that our knowledge of certain lichen structures, organs, functions, etc., etc., is as yet not well understood owing to the fact that our knowledge of lichen evolution and lichen ecology is very incomplete. This accounts for our indefinite and variable terminology. With few exceptions we know practically nothing of the delimitations of species. While this applies especially to the lower forms, it applies also to some of the higher forms, as, for example, *Usnea barbata*, many of the Parmelias, some of the Cladonias, and others. In consideration of these con-

ditions, it is highly absurd for lichen systematists to enter into lengthy and detailed descriptions of species, varieties, subvarieties and even forms. As Fünfstück states, "Bei der ausserordentlich schwankenden Abgrenzung der Arten bei den verschiedenen Autoren ist es geradezu unmöglich eine sichere Orientierung über die Artenzahl zu gewinnen." His further statement that there are in all probability thus far not more than 4,000 good species known harmonizes with the estimates of several other lichenologists. Contrasting this very fair estimate with the fact that some 20,000 species, varieties and forms are actually described it is very evident that there lies an enormous task before those who will attempt to balance this difference. Special care will be necessary in the study and revision of the lower groups. For example, over 100 species, varieties and forms of *Verrucaria* are described. It is more than likely that there are not half that number of good species. This applies also to the genus *Arthonia* as well as to other genera. It may be advisable in some instances to subdivide certain genera. It would appear that Zahlbruckner gives too much systematic importance to the thecial characters, which is however to be expected from one who recognizes the lichens as modified fungi. Too much systematic importance is ascribed to the pycnoconidial apparatus (spermogonia), since the function and occurrence of this organ or structure is but little understood. In brief the subject of lichen classification, as understood at the present time may be summarized as follows :

1. While some authorities are satisfied that lichens deserve to be recognized as an autonomous group, others are not ready to admit this. This difference of opinion does not cause any serious confusion in the conception of lichen groups and species.

2. There is great confusion with regard to the delimitation of lichen species. The number of good species is in all probability less than one fifth of those actually described.

3. The system of classification proposed by Zahlbruckner is excellent and should be generally adopted. This would very materially facilitate the work of studying the various groups more carefully, thus perfecting our knowledge of lichens more and more and making it possible to form a more perfect system in the near future.